

**System and Method for Tab Order
Mapping of User Interfaces**

BACKGROUND OF THE INVENTION

1. Technical Field

5 The present invention relates in general to a system and method for mapping user interfaces. In particular, the present invention relates to a system and method for using the tab order of elements to determine the order in which elements are displayed on a constrained device.

10 **2. Description of the Related Art**

 A common problem in the computer industry is running applications on devices having different form factors and different display sizes. A user may wish, for example, to run Microsoft Word both on this personal computer system at home and on his personal data assistant (PDA) while on the road. The same application user interface, however, will not work on both displays. The Pocket PC display cannot display the same amount of information that an application like Word typically displays on the larger screen of a personal computer. An application's user interface would have to be significantly adapted in order to execute the application on a PDA. Mobile phone displays are more constrained than PDA displays. An application's user interface would need to be modified yet again for an application to execute on a mobile phone.

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 Often, an application designer is required to design a different user interface for each one of the different display types an application is to execute on. In having

to do so, much of the application designer's effort is duplicated. Most of the visual layout of the application's user interface has to be redesigned by specifying a different position for each of the different
5 elements/controls used in the interface.

Currently, most applications use separate style sheets to achieve renderings of the user interface on different types of devices. While this alleviates some of the duplicate effort, it requires the application developer to
10 develop multiple style sheets to achieve appropriate rendering of the user interface across a variety of devices. These devices are not generally platform or container independent.

What is needed therefore is a system and a method that
15 would enable the application designer to more easily design an application that can be used on multiple platforms without much duplicated effort for each additional display/device. In addition, the application designer should be able to specify rules on how the user interface
20 for an application would be rendered (depending on the width, height, and other display capabilities, for example) on devices having different display types.

In particular, what is needed is a system and method that renders elements on a constrained display in an order
25 determined by the tab order of the various displayed elements.

SUMMARY

It has been discovered that a common display page can be displayed on a variety of display devices by using the item's tab order property to determine the display order.

5 Controls that are displayed on a display device typically have a tab order. As used herein, "tab order" refers to any property that indicates an sequencing of field traversal. When a window that has controls is displayed, the cursor is typically placed at the control with the

10 lowest (i.e., first) tab order. As used herein, "cursor" refers to any method of indicating the active entry field, such as highlighting and enabling. When the user presses the tab key, the cursor moves to the control corresponding to the next lowest tab order. This allows the designer to

15 design a single window (or panel) that is displayed differently on constrained devices. However, even though the window is displayed differently, using tab order mapping maintains a consistent visible proximity between controls despite the type of display device being used by

20 the user.

While the tab key is the common control used by software to allow the user to navigate between fields, other keys are anticipated as navigation controls (such as the enter key, arrow keys, cursor key, and function keys)

25 as well as input from the pointing devices (including mouse clicks, mouse chords, and mouse gestures), and other input devices in use and that will be developed. As used herein, "tab order" refers to any indicator of defining an ordered sequence of traversal, visitation, focus, or cursor

movement; including lists, links, pointers, sorting criteria, and the like.

When the window is displayed on a constrained display device, the width of the constrained display device is often not wide enough to accommodate the window as it was designed. In these constrained environments, the controls are displayed in their corresponding tab order. The display area is divided into rows. The first tab ordered control is displayed on the first row. If there is room for the second tab ordered control to be displayed on the first row, it is displayed after (i.e., to the right of) the first control, if there is not enough room, the second control is displayed on the second row. Rows continue to be filled based upon the tab order of the controls. In this manner, several small controls with sequential tab orders can be placed on a single row and controls will be displayed on the next row when the previous row is filled.

The user experience using the window on different display types is consistent as the user can tab from one control to the next and controls with adjacent tab orders are displayed in a location proximate to one another regardless of the display size. In addition, wrapping from one row to the next limits or eliminates the amount of horizontal scrolling the user needs to perform to move from one control to the next. While the examples and descriptions set forth above are for row-based environments, it will be appreciated by those skilled in the art, after reviewing the details set forth herein, that a column based approach will work equally well using these principles with display columns being filled (instead of rows) and the user's tab control moving the cursor first

from the top to the bottom of the display before moving to the next column. In addition, while a left-to-right orientation is described, it will be appreciated by those skilled in the art that a right-to-left orientation will also work. Different orientations may be preferred when using a language that does not operate in a left-to-right, top-to-bottom fashion.

It should be understood that enablement based on tab order is only one method of setting and determining traversal order of fields in an application. As used herein, and with particular in reference to the claims, the term tab order refers any indicator or control of field or focus traversal, visitation, sequencing, cursor motion. It should be understood that the tab key is only one possible initiator of a change in field traversal, and that other keys, such as enter, cursor keys, end keys, etc, and other input devices, such a pointing devices, such as mice, and methods of using such devices, such as mouse clicks, chording, and gestures, can also be used as initiators of field traversal. As used herein, tab key refers to any user control which causes field traversal to change, such as enter, cursor keys, end keys, etc, and other input devices, such a pointing devices, such as mice, and methods of using such devices, such as mouse clicks, chording, and gestures, etc.

The foregoing is a summary and thus contains, by necessity, simplifications, generalizations, and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the present

invention, as defined solely by the claims, will become apparent in the non-limiting detailed description set forth below.

Brief Description of the Drawings

The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the
5 accompanying drawings. The use of the same reference symbols in different drawings indicates similar or identical items.

Figure 1 is a flowchart illustrating a method for rendering an application on devices of different form
10 factors and display capabilities.

Figure 2 is a flowchart illustrating a method for creating an application's user interface for rendering on devices of different form factors and display capabilities;

Figure 3 is an application window illustrating the
15 builder application used in creating an application's user interface;

Figure 4 is a flowchart illustrating a method for determining the "tab order" of the user interface controls;

Figure 5 is an application window illustrating a
20 Control Order Editor window that displays a preview of the tab order of various controls to allow the application designer to change the tab order;

Figure 6 is a flowchart illustrating a method for designating elements to be excluded from rendering on
25 certain devices;

Figure 7A is an application window illustrating a method for selecting from which devices to exclude the

rendering of the "Inventor (Col_Inventor)" user interface control;

Figure 7B is an application window illustrating a method for selecting from which devices to exclude the rendering of the "Lab (Col_Lab)" user interface control;

Figure 8 is flowchart illustrating a method for designating alternative short captions for labeling user interface controls;

Figure 9A is an application window illustrating a method for designating an alternative short caption for the a user interface control;

Figure 9B is an application window illustrating a method for designating an alternative short caption for a user interface control;

Figure 10 is a flowchart illustrating a method for rendering an application according to the device on which the application is to be displayed;

Figure 11 is a flowchart illustrating a method placing captions on user interface controls depending on the device on which the controls are to be rendered;

Figure 12 is a flowchart illustrating a method for determining the layout of user interface controls in a constrained device space;

Figure 13 is an application window illustrating the layout of user interface controls on a device without constrained space;

Figure 14 is an application window illustrating the layout of user interface controls on a device without constrained space;

Figure 15 shows application windows illustrating how
5 the same user interface controls can be layout on devices having different space constraints; and

Figure 16 is a block diagram of an information handling system capable of implementing the present invention.

DETAILED DESCRIPTION

The following is intended to provide a detailed description of an example of the invention and should not be taken to be limiting of the invention itself. Rather,
5 any number of variations may fall within the scope of the invention which is defined in the claims following the description.

Figure 1 is a flowchart illustrating a method for rendering an application on devices of different form
10 factors and display capabilities. Processing begins at **100** whereupon, at step **105**, a request is received to execute and render application **110**, for example. In addition to receiving the code necessary to execute application **110**, information on how to render the application's user
15 interface window on displays of different devices is also received. In one embodiment, the rendering information is provided by the application designer during the design of the user interface. In addition, the rendering information may customized by the user of the device in order for the
20 user interface layout to fit the user's preferences. For example, information may be received on the "tab ordering" of the user interface controls, information may be received on which elements to exclude from the display of which devices, information may be received on the devices
25 requiring short captions in place of regular captions for labeling elements, etc.

At step **105**, information is also received on the type of device on which the application is to be executed. For example, the application may be rendered on the large

display of a personal computer, on the medium-sized and somewhat constrained display of a personal data assistant (PDA), or the application may be rendered on a small and highly constrained display of a mobile phone. Using the
5 information provided by the application designer during the designing of the application and the modifications a user may make to the user interface, the application will be shown differently on displays of different size.

At predefined process **115**, the "tab order" of the user
10 interface controls is determined. The tab order is the order in which the user interface controls are navigated when the user presses the "tab" key on the keyboard or when the user executes a tab-equivalent action. More details on the processing that takes place during predefined
15 process **115** are provided in the flowchart of **Figure 4**.

At predefined process **120**, the elements to be excluded from rendering on a specific display are determined. The application designer or user may specify which elements are not displayed on devices having constrained displays, such
20 as the display of a mobile phone. For example, the designer or user may exclude the rendering of lesser important elements on smaller displays. More details on the processing that takes place during predefined process **120** are provided in the flowchart of **Figure 6**.

25 At predefined process **125**, the elements requiring short captions on the particular device are identified. Short caption information may be provided by the application designer or by the user in order to accommodate the rendering of the application on smaller, constrained
30 displays. More details on the processing that takes place

during predefined process **125** are provided in the flowchart of **Figure 8**.

At predefined process **130**, the application is rendered on the selected device using the information determined in the previous steps. More details on the processing that takes place during predefined process **130** are provided in the flowchart of **Figure 10**.

Figure 2 is a flowchart illustrating a method for creating an application's user interface for rendering on devices of different form factors and display capabilities. Processing begins at **200** whereupon, at step **210**, a widget is selected from palette **215**. The widget may be, for example, a table, a tree, or an input field to be used as part of the user interface. At step **215**, the selected widget is dragged by the application designer and positioned on the user interface design canvas **220** to begin designing the application.

At step **225**, the default "tab order" for the selected widget is set (i.e., the next tab order following the last tab order currently shown on user interface **220**). The tab order is the order in which the user interface controls are navigated when a user presses the "tab" key on the keyboard or when the user executes another tab-equivalent action. The tab order defines the logical flow of data input for the application. The selected tab order is stored in properties storage **230**. The information stored in properties storage **230** is provided to a device to be used in the proper rendering of the application by the device.

A determination is then made as to whether the tab order for the selected widget is to be modified at

decision **235**. If the tab order of the widget is to be changed, decision **235** branches to "yes" branch **237** whereupon, at step **240**, the tab order for the widget is changed and the new tab order is updated in properties storage **230**. On the other hand, if the tab order does not need to be modified, decision **235** branches to "no" branch **239** bypassing step **240**. Processing then continues at decision **245**.

A determination is made as to whether the widget (element) is to be excluded from rendering on certain devices. If the widget is to be excluded from rendering on certain devices, decision **245** branches to "yes" branch **247** whereupon, at step **250**, a selection is made as to from which devices/displays the widget/element is to be excluded. For example, the widget may be excluded from rendering on the display of a specific device such as PDA or a mobile phone but not from the display of a personal computer system. The exclusion information is then saved in properties storage **230**. In another embodiment, an element may be excluded from a class or group of devices as opposed to the element being excluded from specific devices. For example, the element may be excluded from rendering on mobile phone-type displays. If the widget is not to be excluded from rendering on any devices, decision **245** branches to "no" branch **249** bypassing step **250**. Processing then continues at decision **255**.

At decision **255**, a determination is made as to whether a short caption will be used to label the widget. A short caption may be used as an alternative to a longer caption on devices having constrained displays. If a short caption is to be used to label the widget, decision **255** branches to

"yes" branch **257** whereupon, at step **260**, the short caption option is selected for the widget, and a short caption is entered. The short caption information is saved in properties storage **230**. If a short caption is not to be
5 used, decision **255** branches to "no" branch **259** bypassing step **260**. Processing continues at decision **265**.

A determination is made at decision **265** as to whether the application designer wants to place more widgets on the user interface design canvas. If there are more widgets to
10 be placed on the design canvas, decision **265** branches to "yes" branch **267** where processing loops back to step **210** for the next widget to be placed on the canvas and its properties to be set by the designer.

This looping continues until there no more widgets to
15 be added to the canvas, whereupon decision **265** branches to "no" branch **269** whereupon, at step **270**, the designed user interface along with the rendering properties **230** for rendering the interface are saved in application interface storage **275**. Processing subsequently ends at **299**.

20 **Figure 3** is an application window illustrating the builder application used in visually creating an application's user interface. Window **300** shows an example how the builder application toolkit window may appear while designing the application's user interface. The toolkit
25 contains a set of menus from which the application designer can select and perform certain actions related to the user interface design.

Window **320** shows a list of the different projects an application designer may be working on. The application
30 designer may switch between the different projects by

selecting a project from the tree structure shown in window **320**.

Window **305** shows different ways an application designer may choose to select objects on the user interface design canvas. For example, the application designer may
5 choose to select elements by row, column, etc.

Window **325** is the design canvas showing a preview of the user interface design in progress. The application designer can use this preview window to see how the
10 application may be rendered on a given device, including the tab order of the elements, which elements are to be excluded, which elements will be using short captions, etc. The application designer may specify to which device/display the preview window corresponds.

15 Window **310** shows a list of the controls an application designer may choose to place on the design canvas. The controls or elements may include edit boxes, images, labels, listboxes, groups for grouping sets of controls, etc. Window **330** shows a list of the elements that the
20 application designer has already placed on the user interface design canvas. The window also indicates the grouping, if any, of the elements. For example, button1 and button2 are shown to both belong to group1.

Window **335** shows a list of the properties associated
25 with a selected element that the application designer has placed on the user interface design canvas. Using the element's properties, the application designer may designate a caption for the selected element, control overrides for the element, etc.

Figure 4 is a flowchart illustrating a method for determining the "tab order" of the user interface controls. In one embodiment, a separate window may be generated to show the application designer or the user the tab order of the different controls and to allow the user or the application designer to change the controls' tab order. The tab order defines the logical flow of data input for the application. Processing begins at **400** whereupon, at step **405**, the first control is selected and the control's properties are retrieved from control properties **410**.

A determination is then made as to whether the control is tab-able (decision **415**). In one embodiment, whether a control is tab-able can be determined by inspecting the control's TabStop property. If the control is tab-able, decision **415** branches to "yes" branch **417** whereupon, at step **420**, the tab-order index for the control is retrieved. The tab index indicates the tab order chosen by the application designer for that control. At step **425**, the tab order index is overlaid and displayed on the control. On the other hand, if the control is not tab-able, decision **415** branches to "no" branch **419** bypassing steps **420** and **425**. Processing subsequently continues at decision **440**.

A determination is made as to whether more controls remain for which the tab order is to be determined at decision **440**. If more controls remain, decision **440** branches to "yes" branch **442** whereupon, at step **435**, the next control is selected from control properties data store **410** and processing loops back to process the newly selected control. This looping continues until there are no more controls remain to be processed, at which time

decision 440 branches to "no" branch 444. At step 445, the user interface window is displayed with the tab order index overlaid on the controls. At this point the application designer or the user may change the tab order given to the controls by the application designer. In one embodiment, the application designer or user changes the tab order by selecting the overlaid tab number corresponding to the control and either changing the number using the keyboard or dragging the number to a different control, whereupon the tab order numbers for the two controls are swapped.

A determination is then made as to whether the application designer or the user has selected to change the tab order for one or more of the controls at decision 450. If the user wishes to change the tab order, decision 450 branches to "yes" branch 452 whereupon, at step 455, the changed tab order is saved in control properties data store 410. On the other hand, if the application designer or the user does not change the tab order data, decision 450 branches to "no" branch 460 bypassing step 455. Processing thereafter ends at 499.

Figure 5 is an application window illustrating the Control Order Editor window that displays a preview of the tab order of various controls to allow the application designer or the user to change the tab order. As shown, the current tab order of the controls layout on user interface window 500 is: (1) text field 505, (2) input field 510, (3) text field 515, (4) input field 520, (5) multiple-column field 525, (6) label 530, (7) table 535, (8) "OK" button 540, (9) "cancel" button 545, and (10) group 548. The application designer or user can accept the current order by clicking "OK"

button **555** or exit the Control Order Editor without saving any changes by clicking "Cancel" button **565**.

The application designer or user may select a control in order to change the tab order of the control by clicking
5 on the control using the left mouse button, or the user may select a control using the right mouse button to alter tab properties. In addition, the user can select one of the tab controls and drag it to a different tab control, whereupon the tab order numbers of the two controls are
10 swapped. After making changes, the application designer may click on "OK" button **555** or the application designer may click on "Default" button **550** to return the tab order of the controls to the original tab order.

Figure 6 is a flowchart illustrating a method for
15 designating elements to be excluded from rendering on certain devices. Processing begins at **600** whereupon, at step **610**, the user selects the control to be added to the excluded elements list.

At step **615**, the user requests the display of a list
20 of available renderers. The list is obtained from supported environments data store **620**. The list may include, for example, a personal computer environment, a PDA environment, a pocket PC environment, and a mobile phone environment. In another embodiment, the received
25 list may include classes or group of devices as opposed to specific devices or specific environments. At step **625**, the application designer or user selects the renderer(s) or classes of renderers from which the selected control is to be excluded.

A determination is then made as to whether the changes made by the user are to be saved (decision **630**). If the changes are to be saved, decision **630** branches to "yes" branch **632** whereupon, at step **635**, the selected
5 environments from which the element is to be excluded are recorded in control properties data store **640**. On the other hand, if the user elects not to save the changes, decision **630** branches to "no" branch **634** bypassing step **635**.

10 A determination is made as to whether the user wants to select another control to be excluded from one or more environments (decision **645**). If another control is to be excluded, decision **645** branches to "yes" branch **647** whereupon processing loops back to step **610** for the next
15 control to excluded. Processing continues to loop back until no more controls are selected, at which point decision **645** branches to "no" branch **649** whereupon processing ends at **699**.

Figure 7A is an application window illustrating a
20 method for selecting devices from which to exclude the rendering of a control. In the example shown, the "Inventor (Col_Inventor)" user interface control is being excluded from Pocket PC environments and from Cell Phone environments. As shown, window **705** includes selection
25 box **710** that contains the names of all the controls available on the user interface. A user selects the control to be excluded in selection box **710** and also selects the renderers from which the control is to be excluded by checking one of the checkboxes (checkboxes **715**
30 - **730**). If the user selects checkbox **715**, the control is to be excluded from HTML 4.0 preview; if the user selects

checkbox **720**, the control is to be excluded from IBM Swing;
if the user selects checkbox **725**, the control is to be
excluded from Pocket PC Preview; and if the user selects
checkbox **730**, the control is to be excluded from Cell Phone
5 Preview. As part of the Java Foundation Classes (JFC), the
IBM Swing component set builds on the Abstract Window
Toolkit (AWT) to provide a pure Java-based graphical user
interface (GUI) for programs. The user can check any
number of checkboxes.

10 In another embodiment, the user or application
designer may be given choices of classes of
displays/devices from which an element or elements are to
be excluded as opposed to specific devices. For example,
the choices may be: personal computer-type displays, PDA-
15 type displays, and mobile phone-type displays.

The user may then click on "OK" button **732** to accept
and save the changes made, or the user may click on
"Cancel" button **734** to reject the changes made.

Figure 7B is an application window illustrating a
20 method for selecting devices from which to exclude the
rendering of a control. In the example shown, the "Lab
(Col_Lab)" user interface control is being excluded from
Cell Phone environments. As shown, window **735** includes
selection box **710** that contains the names of all the
25 controls available on the user interface. A user may first
select the control to be excluded in selection box **740** and
proceed to select the renderers from which the control is
to be excluded. If the user selects checkbox **745**, the
control is to be excluded from HTML 4.0 preview; if the
30 user selects checkbox **750**, the control is to be excluded

from IBM Swing; if the user selects checkbox **755**, the control is to be excluded from Pocket PC Preview; and if the user selects checkbox **760**, the control is to be excluded from Cell Phone Preview.

5 In another embodiment, the user or application designer may be given choices of classes of displays/devices from which an element or elements are to be excluded as opposed to specific devices. For example, the choices may be: personal computer-type displays, PDA-
10 type displays, and mobile phone-type displays.

 The user may then click on "OK" button **765** to accept and save the changes made, or the user may click on "Cancel" button **770** to reject the changes made. Using the selections made in the examples shown in **Figures 7A** and **7B**,
15 when a Cell Phone environment is used, the inventor column and the lab column will be excluded. When a Pocket PC environment is used, only the inventor column will be excluded, and neither column will be excluded when using the HTML environment or the IBM Swing environment.

20 **Figure 8** is flowchart illustrating a method for designating alternative short captions for labeling user interface controls. Processing begins at **800** whereupon, at step **805**, the user selects, from control properties **870**, the control for which a short caption is to be entered. At
25 step **810**, a list of available renderers is received from supported environments storage **815**. The list may include, for example, a personal computer, a PDA, and a mobile phone. At step **820**, the user enters the short caption to be used with the selected control, and at step **825**, the
30 user selects the renderers in which the short caption is to

be displayed. The user may select one or more of the renderers in order to display the short caption in each of the renderers. In another embodiment, the user may designate a different short caption for each of the
5 different types of renderers.

A determination is then made as to whether to save the changes made to the short caption(s) at decision **830**. If the changes are to be saved, decision **830** branches to "yes" branch **835** whereupon the short caption for the selected
10 environment(s) is saved at step **845** in control properties data store **870**. On the other hand, if the changes are not to be saved, decision **830** branches to "no" branch **840** bypassing step **845**. A determination is made as to whether more short captions are to be entered for other controls
15 (decision **850**). If more captions are to be entered, decision **835** branches to "yes" branch **857** whereupon processing loops back to step **820** for the next short caption to be entered. This looping continues until no more short captions are entered for the control, at which
20 point decision **850** branches to "no" branch **859**.

A determination is made as to whether the user or application designer selects another control for which a short caption is to be entered (decision **860**). If there are more controls remaining, decision **860** branches to "yes"
25 branch **862** whereupon processing loops back to step **805** where the next control is processed. This looping continues until there are no more controls to be processed, at which time decision **860** branches to "no" branch **864** whereupon processing ends at **899**.

Figure 9A is an application window illustrating a method for designating an alternative short caption for a control is shown. In the example, the "Location (Lbl_Text_Location)" user interface control is provided with a short caption. As shown, window **905** includes combo box **910** that is used to select a control from a list of all the controls available on the user interface. A user or application designer selects the control for which a caption is to be entered in combo box **910** and proceed to enter the short caption in text box **912**. In the example shown, the short caption "Loc" is provided for the "Location" control.

The user selects the renderers in which the short caption is to be displayed. If the user selects check box **915**, the short caption is to be displayed the HTML 4.0 preview; if the user selects check box **920**, the short caption is to be displayed the IBM Swing; if the user selects check box **925**, the short caption is to be displayed the Pocket PC Preview; and if the user selects check box **930**, the short caption is to be displayed the Cell Phone Preview. In the example shown, the "Loc" short caption is to be used for the "Location" control in the Pocket PC environment, as noted by the corresponding checkmark.

The user may then click on "OK" button **935** to accept the changes made, or the user may click on "Cancel" button **940** to reject the changes made.

Figure 9B is another application window illustrating a method for designating another short caption. In the example shown, the "Lab (Lbl_Text_Lab)" user interface

control is provided with a short caption of "L" in a Cell Phone environment. As shown, window 945 includes combo box 950 that is used to select a control from a list of all the controls available on the user interface. A user or
5 application designer selects the control for which a caption is to be entered in combo box 950 and proceed to enter the short caption in text box 952.

The user selects the renderers in which the short caption is to be displayed. If the user selects check
10 box 955, the short caption is to be displayed in an HTML 4.0 preview; if the user selects check box 960, the short caption is to be displayed in an IBM Swing environment; if the user selects check box 965, the short caption is to be displayed the Pocket PC Preview; and if
15 the user selects check box 970, the short caption is to be displayed the Cell Phone Preview. In the example shown, the short caption "L" is being provided for "Lab" in the Cell Phone environment, as noted by the checkmark.

The user may then click on "OK" button 975 to accept
20 the changes made, or the user may click on "Cancel" button 980 to reject the changes made.

Figure 10 is a flowchart illustrating a method for rendering an application according to the device on which the application is to be displayed. Processing begins
25 at 1000 whereupon, at step 1005, the device registers the device's renderer keys, and at step 1010, the first element to be rendered is selected based upon the tab order of the elements. The tab order is obtained from control properties data store 1020.

At step **1015**, any excluded environments (where the element is not to be rendered) are read and identified for the selected element. An element may have one or more environments from which the element is to be excluded. A
5 determination is then made as to whether the device currently used by the user matches one of the excluded environments for the selected element at decision **1030**.

If the current device does not match any of the excluded environments, decision **1030** branches to "no"
10 branch **1034** whereupon, at step **1035**, a short caption is read, if one exists, from control properties data store **1020** to be displayed with the element on the current device. The element's caption and the corresponding control are positioned on the user's interface (predefined
15 process **1040**). More details on the processing that takes place at step **1040** are provided in the flowchart and corresponding text of **Figure 11**.

On the other hand, if the device currently used by the user matches an excluded environment, decision **1030**
20 branches to "yes" branch **1032** bypassing step **1035** and predefined process **1040** so that the selected element is not rendered (i.e., is excluded) from the user's display.

A determination is then made as to whether more elements are to be rendered for the window at
25 decision **1045**. If there are more elements to be rendered, decision **1045** branches to "yes" branch **1047** whereupon, at step **1048**, the next element to be rendered is selected from the control properties data store **1020** in the tab order, and processing loops back to process the newly selected
30 element. This looping continues until there are no more

elements to be rendered, at which point decision **1045** branches to "no" branch **1049** whereupon, at step **1050**, the non-excluded captions and controls are displayed in the tab order of the captions/controls. Processing thereafter ends at **1099**.

Figure 11 is a flowchart illustrating a method for placing captions on user interface controls depending on the device on which the controls are to be rendered. Processing begins at **1100** whereupon, at step **1105**, the user's preferred language is identified.

A determination is made as to whether a short caption is to be used with the selected element at decision **1110**. If a short caption is to be used, decision **1110** branches to "yes" branch **1112** whereupon, at step **1115**, an attempt is made to locate the short caption in the user's selected language in national language support (NLS) data store **1120**. In one embodiment, NLS **1120** is configured to store element captions and short captions in one or more languages in order to provide multilingual support. A determination is then made as to whether a translation for the short caption was found at decision **1125**. If the translation was not found, decision **1125** branches to "no" branch **1129** whereupon processing continues at step **1135**.

Returning to decision **1110**, if a short caption is not to be used, decision **1110** branches to "no" branch **1114** whereupon processing continues at step **1135**. At step **1135**, the element's full caption is located in the user's language in NLS database **1120**. A determination is then made as to whether a translation was found for the full caption at decision **1150**. If a translation for the caption

was found, decision **1150** branches to "yes" branch **1152** whereupon the translated caption is selected as the caption for the selected element at step **1165**. On the other hand,, if a translation was not found, decision **1150** branches to
5 "no" branch **1154** whereupon a default (e.g., English) caption is selected. Processing subsequently continues at decision **1140**.

Returning to decision **1125**, If a translation for the short caption was found, decision **1125** branches to "yes"
10 branch **1127** whereupon, at step **1130**, the translated short caption is selected as the caption for the selected element.

At decision **1140**, a determination is made as to whether this is a device with a constrained display. If
15 this is a constrained device, decision **1140** branches to "yes" branch **1182** whereupon, the captions and controls are laid out in the constrained environment (predefined process **1185**, see **Figure 12** and corresponding text for processing details). On the other hand, if this is not a constrained
20 device, decision **1140** branches to "no" branch **1188** whereupon, at step **1190** the captions and controls are laid out in default positions. In one embodiment, the default position may be obtained from control properties data store **1180**. Processing subsequently returns to the calling
25 routine at **1199**.

Figure 12 is a flowchart illustrating a method for determining the layout of user interface controls in a constrained device space. Processing begins at **1200** whereupon, at step **1205**, the selected caption and control
30 are received from the calling routine.

At step **1210**, the constrained dimensions (width and height) of the display of the device are received, and at step **1215**, the space available on the current rendering row is identified. In one embodiment, elements are rendered in a row until there is no more space available on the current row.

A determination is then made as to whether the length of the caption is greater than the length of the row at decision **1220**. If the text length is greater than the length of the row, decision **1220** branches to "yes" branch **1222** whereupon, at step **1225**, the text is wrapped to the next row. On the other hand, if the text length is less than the row length, decision **1220** branches to "no" branch **1224** bypassing step **1225**.

At decision **1230**, a determination is made as to whether the current row has enough available space to display the selected control. If there is not enough available space, decision **1230** branches to "no" branch **1234** whereupon, at step **1250**, a new row is inserted below the current row. At step **1255**, the current row now becomes the new row, and at step **1260**, the caption and/or control are placed in the new row. At step **1265**, the row height is set as needed to fit the caption/control. Processing subsequently continues at step **1268**.

If space is available on the current row, decision **1230** branches to "yes" branch **1232** whereupon, at step **1235**, the height of the row is modified as needed to fit the caption/control. At step **1240**, the caption and/or control is placed next to the element already rendered, and

at step **1268**, the elements are rendered. Processing subsequently returns to the calling routine at return **1299**.

Window **1270** shows an example of how elements might be rendered on a constrained display area.

5 Caption/control **1272** and caption/control **1274** are both placed in the first row. Caption/control **1276** cannot fit in the first and is thus placed in the second row. Similarly, caption/control **1278** is placed in the third row. Caption/control **1280** and caption/control **1290** can fit in

10 one row and are thus placed next to each other in the fourth row. The placement process continues until all the captions/controls have been placed including N^{th} caption/control **1292**.

Figure 13 is an application window showing the layout

15 of user interface controls on a device without constrained display space. Window **1300** contains text field element **1305** and text field element **1310**, which are placed next to each other. The table containing all of the inventors' names is placed under the two text fields. The

20 table is rendered with all columns present as well as full captions for all the columns. Since this is not a constrained device, there is no need, for example, to vertically stack the two text fields, use short captions, or exclude any elements. The user uses the window and

25 clicks on "OK" button **1320** to accept and save the changes or clicks on "Cancel" button **1325** to reject any changes that were made.

Figure 14 is an application window showing the layout of user interface controls on a device with constrained

30 space. Window **1400** contains text field element **1405** and

text field element **1410**. In this case, there is not enough room to render the two fields side-by-side, and thus, the two text field elements are rendered vertically one above the other (in tab order). In addition, table **1420** is shown here rendered with the short caption for the first (location) column (i.e., short caption "Loc" appears). In addition, window **1400** contains selection box **1415** where a user can choose not to display table **1420** if the user does not wish to see the table, thus saving additional display space in cases where display space is critical.

Figure 15 shows application windows illustrating how the same user interface controls can be layout on devices having different display space constraints. Window **1500** is shown as the window would be displayed on a non-constrained device. Window **1500** contains text field **1505** and text field **1510**, which is placed horizontally next to text field **1505**. In addition, non-constrained window contains table **1515** having the location, the lab, and the name of each inventor. All the columns in the table are shown and full captions are used to label all the elements. If any changes are made, the user clicks "OK" button **1520** to accept and save the changes or clicks on "Cancel" button **1525** to reject any changes made.

Window **1530** shows the same window that was created and displayed in Pocket PC window **1530**. Since there is not enough room in the first row, text field **1535** and text field **1540** are rendered on two separate rows. In addition, read-only text **1545** is wrapped so that it is displayed without the user needing to horizontally scroll to view all of the text. Furthermore, the "Inventors" column in the table has been designated as "excluded" from a Pocket PC

environment, and thus, this column does not appear in the window. In addition, a short caption has been designated to be used for the Location column ("Loc" displayed instead of "Location") in order to save additional rendering space
5 for the table.

Window **1550** shows the same window that was created and displayed in Cell Phone window **1530**. Since there is not enough room in the first row, text field **1555** and text field **1560** are rendered on two separate rows. In addition,
10 read-only text **1565** is wrapped so that it is displayed without the user needing to horizontally scroll to view all of the text. Furthermore, the "Location" column and the "Inventors" column have been designated as "excluded" from a Cell Phone environment, and thus, these columns do not
15 appear in the window. In addition, a short caption has been designated to be used for the Lab column ("L" displayed instead of "Lab") in order to save additional rendering space for the table. Finally, short caption **1570** has been provided to abbreviate state names, so that the
20 abbreviation "NC" appears instead of "North Carolina."

Figure 16 illustrates information handling system **1601** which is a simplified example of a computer system capable of performing the computing operations described herein. Computer system **1601** includes processor **1600** which is
25 coupled to host bus **1602**. A level two (L2) cache memory **1604** is also coupled to host bus **1602**. Host-to-PCI bridge **1606** is coupled to main memory **1608**, includes cache memory and main memory control functions, and provides bus control to handle transfers among PCI bus **1610**,
30 processor **1600**, L2 cache **1604**, main memory **1608**, and host bus **1602**. Main memory **1608** is coupled to Host-to-PCI

bridge **1606** as well as host bus **1602**. Devices used solely by host processor(s) **1600**, such as LAN card **1630**, are coupled to PCI bus **1610**. Service Processor Interface and ISA Access Pass-through **1612** provides an interface between
5 PCI bus **1610** and PCI bus **1614**. In this manner, PCI bus **1614** is insulated from PCI bus **1610**. Devices, such as flash memory **1618**, are coupled to PCI bus **1614**. In one implementation, flash memory **1618** includes BIOS code that incorporates the necessary processor executable code for a
10 variety of low-level system functions and system boot functions.

PCI bus **1614** provides an interface for a variety of devices that are shared by host processor(s) **1600** and Service Processor **1616** including, for example, flash
15 memory **1618**. PCI-to-ISA bridge **1635** provides bus control to handle transfers between PCI bus **1614** and ISA bus **1640**, universal serial bus (USB) functionality **1645**, power management functionality **1655**, and can include other functional elements not shown, such as a real-time clock
20 (RTC), DMA control, interrupt support, and system management bus support. Nonvolatile RAM **1620** is attached to ISA Bus **1640**. PCI-to-SCSI bridge **1680** provides bus control to handle transfers between PCI bus **1614** and SCSI bus **1685**. SCSI device **1690** (i.e. a SCSI hard drive)
25 communicates with other parts of computer system **1601** using SCSI bus **1685**.

Service Processor **1616** includes JTAG and I2C busses **1622** for communication with processor(s) **1600** during initialization steps. JTAG/I2C busses **1622** are also
30 coupled to L2 cache **1604**, Host-to-PCI bridge **1606**, and main

memory **1608** providing a communications path between the processor, the Service Processor, the L2 cache, the Host-to-PCI bridge, and the main memory. Service Processor **1616** also has access to system power resources for powering down
5 information handling device **1601**.

Peripheral devices and input/output (I/O) devices can be attached to various interfaces (e.g., parallel interface **1662**, serial interface **1664**, keyboard interface **1668**, and mouse interface **1670** coupled to ISA
10 bus **1640**. Alternatively, many I/O devices can be accommodated by a super I/O controller (not shown) attached to ISA bus **1640**.

In order to attach computer system **1601** to another computer system to copy files over a network, LAN card **1630**
15 is coupled to PCI bus **1610**. Similarly, to connect computer system **1601** to an ISP to connect to the Internet using a telephone line connection, modem **1675** is connected to serial port **1664** and PCI-to-ISA Bridge **1635**.

While the computer system described in **Figure 16** is
20 capable of executing the processes described herein, this computer system is simply one example of a computer system. Those skilled in the art will appreciate that many other computer system designs are capable of performing the processes described herein.

25 One of the preferred implementations of the invention is an application, namely, a set of instructions (program code) in a code module which may, for example, be resident in the random access memory of the computer. Until

required by the computer, the set of instructions may be stored in another computer memory, for example, on a hard disk drive, or in removable storage such as an optical disk (for eventual use in a CD ROM) or floppy disk (for eventual
5 use in a floppy disk drive), or downloaded via the Internet or other computer network. Thus, the present invention may be implemented as a computer program product for use in a computer. In addition, although the various methods described are conveniently implemented in a general purpose
10 computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the required method steps.

15 While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore,
20 the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the appended claims. It will be understood by those with skill
25 in the art that if a specific number of an introduced claim element is intended, such intent will be explicitly recited in the claim, and in the absence of such recitation no such limitation is present. For a non-limiting example, as an aid to understanding, the following appended claims contain
30 usage of the introductory phrases "at least one" and "one or more" to introduce claim elements. However, the use of

such phrases should not be construed to imply that the introduction of a claim element by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim element to inventions containing only one
5 such element, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an"; the same holds true for the use in the claims of definite articles.